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CASE HISTORY OF XF-92

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CASE HISTORY OF XF-92

[redacted]

Auth: CG AMC
Initials: PMD
14 June 1949

Prepared by
Historical Office
Executive Secretariat
Air Materiel Command
Wright-Patterson Air Force Base
June 1949

By

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Historian

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GLOSSARY OF ABBREVIATIONS

AAF	Army Air Forces
Aero.	Aeronautical
AFP	Authority for Purchase
AMC	Air Materiel Command
B	Area B
Br.	Branch
C	Confidential
CF	Central Files
CG	Commanding General
Cir.	Circular
conf.	conference
contr.	contract
CVAC	Consolidated Vultee Aircraft Corporation
Div.	Division
Eng.	Engineering
Engr.	Engineer
ft.	foot, feet
GALCIT	Guggenheim Aeronautical Laboratory, California Institute of Technology
GFE	Government-Furnished Equipment
Hist.	Historical
hp	horsepower
Ibid.	Ibidem
info.	information
JATO	jet assisted take-off
Lab.	Laboratory
lb.	pound
lox	liquid oxygen
Ltr.	Letter
Memo.	Memorandum
min.	minute, minutes
mm.	millimeter
mph	miles per hour

NACA	National Advisory Committee for Aeronautics
No.	Number
p.(pp.)	page (pages)
proj.	project
R	Restricted
R&D	Research and Development
S	Secret
Sect.	Section
Tel. Conv.	Telephone Conversation
USAF	United States Air Force
WD	War Department
wt.	weight

READING AIDS

Numbers in the text refer to documents
in Appendix, Volume I

Asterisks in the text refer to footnotes.

[redacted]

I. INTRODUCTION

In August 1945 the AAF released tentative military characteristics for three types of fighter aircraft—Interceptor, Penetration, and All Weather. The military characteristics for an Interceptor fighter called for a high speed, high performance, high altitude aircraft designed to destroy attacking enemy aircraft and airborne missiles. The XF-92 airplane was designed by Consolidated Vultee Aircraft Corporation to meet the Interceptor requirements. It is a single-place, land-based, rocket propelled fighter aircraft intended to combat high performance enemy aircraft or guided missiles and designed to operate close to its base as a last line of defense. To achieve its tactical function it must reach combat altitudes in a very short time and must be directed to the vicinity of the target from the ground because of its limited endurance. In effect, the XF-92 is a nonexpendable, inhabited missile with a pilot guiding the plane to its target. Since the aircraft is inhabited, it can return to its base to be used again.*

Primarily, the XF-92 project has been one of experimentation and development. Extensive study and testing have been required to work out the many tactical, aerodynamic, thermodynamic, and structural problems involved in the design of an aircraft radical in configuration and method of propulsion and capable of operating at speeds ranging

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* The XF-92 Proj. Engineer's notebook (C), W. R. Rankin's personal files, Fighter Br., Eng. Div.

[redacted]

from subsonic to supersonic. The XF-92 is the only delta wing plane under development by the USAF, and it is also the only tactical plane to be completely rocket propelled. In addition to solving the difficulties presented by these two major experimental features, it has been necessary to develop components for the major features. Everything was being done for the first time; therefore each step in the program was accomplished by the cut-and-try method. The many changes made in design, sometimes at the suggestion of the ARC, sometimes at the suggestion of the contractor, all delayed the project and increased the costs far beyond the original figure. For example, the initial flight of the flying prototype, Model 7002, took place a year later than scheduled.*

Design and engineering problems, however, were not entirely responsible for the slow-down. Other contributing factors will be discussed in detail later in the study, but may be mentioned here as follows: The Consolidated plant was moved en masse from Downey, California, to San Diego during the summer of 1947; consequently design and production schedules were upset and the resultant confusion and delay increased the expense of the project. Also, the procurement of rocket engines for the XF-92 power plant installation was delayed because of difficulties arising from the apparently insecure financial condition of Reaction Motors, Incorporated, of

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* Interview with W. R. Rankin, XF-92 Proj. Engr., 9 Aug. 1948.

Dover, New Jersey. The difficulty encountered in obtaining a formal contract with that company delayed the availability of the rocket engines to the extent that they became a critical item and retarded development of the tactical plane.*

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* Interview with W. R. Rankin, 10 Aug. 1948.

II. INITIATION OF PROJECT

When the tentative characteristics for fighter aircraft were released by the Assistant Chief of Air Staff, Requirements (AC/AS-3), in August 1945,* the aviation industry was invited to participate in an informal design competition and to submit design proposals accordingly. The characteristics set forth requirements for performance (including speed, climb, endurance, and controllability), armament, fuel, equipment, instruments, and structure and design features.[1] The design proposals submitted by the various contractors were reviewed and evaluated by the AMC, and authority to negotiate for Phase I of the Consolidated Vultee proposal bid was granted 22 March 1946.[3] Procurement of the interceptor fighter was to be handled on a two-phase basis: the first phase was to cover research, design, and construction of a mock-up; the second phase was to carry on from the mock-up through the initial flight test phase.[39]

Studies which Consolidated Vultee had been making on a new transonic plane for the AAF culminated in the design submitted by it in the competition. The original design incorporated a 45° sweptback wing, a "V" tail, and bicycle landing gear supplemented by a droppable take-off gear. The plane was to be powered by

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* These characteristics were formalized later into Military Characteristics of Aircraft, Interceptor Fighter, dated 23 Nov. 1945 and revised 5 Feb. and 8 Oct. 1946.

fifteen 50-pound thrust rocket engines mounted in a duct which could be used as a ram jet power plant at high speeds if fuel were injected into the duct behind the rocket engines. The rockets would then act as flame holders. Four 1,500-pound thrust rocket engines were to be used for take-off and climb to 50,000 feet; a Westinghouse 19XB turbo-jet engine was to drive all accessories and was to be used for power landings.[39]

In April 1946 the model number XP-92, now XF-92, was assigned to the plane.[4] The project was designated MX-813. It carried an over-all classification of Restricted, but all performance data was to be Confidential.[5] At the beginning of the project it was assigned a priority of 2-A,[41] which indicated that the project might result in items of materiel possessing such marked superiority over existing items that complete or extensive replacement would be justified.* It is interesting to note that the project has been carried under two other priorities (1-B and 1-C) since its inception, and this fact points to a fluctuation of interest in the project. In August 1947, at the same time a resumé and justification of the XF-92 was written,[39,40] the priority was reviewed and raised to 1-B.[41] (Priority 1-B is assigned to projects for new tactical concepts of warfare or for new concepts of warfare resulting from radically new materiel developed by major scientific advancements.)* The

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* WD Cir. 71, 18 Mar. 1947, and extended by WD Cir. 264, 27 Aug. 1948.

project continued under the 1-B priority until August 1948 when it was downgraded to 1-C by the Engineering Division Project Review Board, AMC.* The 1-C priority is assigned to projects necessary to the "timely accomplishment of important assigned missions . . ."**

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* Tel. Conv. with W. R. Rankin, XF-92 Proj. Engr., 5 Nov. 1948.
** WD Cir. 71, 13 Mar. 1947, and extended by WD Cir. 264, 27 Aug. 1948.

III. PROCUREMENT

In March 1946 authority was granted from Washington to negotiate for Phase I of the Vultee fighter bid.[3] Authority for Purchase (AFP) No. 431491, dated 11 April 1946, requested that a letter contract covering Phase I procurement be issued to Consolidated Vultee of Downey, California. Phase I included: (1) the design, construction, and testing of wind tunnel models; (2) engineering data; and (3) a mock-up of the XF-92 airplane. The estimated cost, as shown in this AFP, was $850,000, and the project was approved as a part of the Fiscal Year 1946 Research and Development Program.[6] AFP 431491 was later canceled and superseded by AFP 438981, dated 4 June 1946. The latter AFP was issued after the entering-in date (May 1946) of the letter contract and provided for a further increase in funds. AFP 438981, covering both Phase I and Phase II, stated that funds to the extent of $7,514,000.78 had been allotted for the project. The contract number W33-038 ac-14547, assigned as a result of the original AFP, was to be retained.[7]

Contract W33-038 ac-14547

Meanwhile, by 2 May the letter contract previously referred to had been formulated. This contract provided for both phases of the XF-92 development and a corresponding increase in estimated cost from $850,000, as provided in AFP 431491, to $5,300,000. The extensive model program included in Phase I called for the design and testing of

the following models: power plant research, duct, full-scale fuselage, wing plan form, high speed, spin, and full-scale mock-up. The testing of these models was to take place in tunnels and laboratories designated by the contract, such as the Ames Aeronautical Laboratory at Moffett Field, NACA facilities at Cleveland and at Langley Field, the Co-op Tunnel and the Guggenheim Aeronautical Laboratory (GALCIT), both at the California Institute of Technology, and others. Model specifications, photographs, wind tunnel reports, drawings, and complete engineering data were to be submitted as the work progressed.[9]

Phase II was set up to cover the design, development, tooling, and construction of two tactical airplanes, one "skeleton" or static test article, one full-scale mock-up, and the necessary engineering data.[8] The letter contract was accepted by Consolidated on 25 June. The type of definitive contract contemplated was cost-plus-a-fixed-fee. At this time it was expected that a definitive contract would be placed with Consolidated by 1 August,[9] but this expectation was not realized.[10] It was necessary that the AMC receive a suitable model specification upon which to prepare the definitive contract, and the first such specification was not furnished by the contractor until the end of September. Negotiations between the contractor and the AMC concerning XF-92 procurement had continued for several months before any action was taken. In January 1947 the AMC prepared a definitive contract which was executed by the contractor subject to

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the incorporation of certain changes. The contract was returned to the AMC in March. Numerous revisions were proposed by both parties with the result that no definitive contract had been formalized by January 1949. A letter from the contractor to the AMC, dated 26 September 1947, stated that the failure to formalize such a contract "[was] not the result of any fundamental disagreement between the parties over contract terms, but rather the natural result of the inherent complexities of the project."[44] Therefore, since no definitive contract was formalized on the XF-92 airplane, the contractor proceeded in accordance with the original Letter Contract W33-038 ac-14547, approved 28 June 1946, and amendments thereto.

Because of the extremely experimental nature of the project, changes in the program were necessary from time to time, and these are reflected in the amendments to the contract. A discussion of the most important amendments follows. Amendments 9 and 20 are concerned with the cost of the project; amendments 4, 14, and 17, with the engineering program.

> Amendment 9, dated 1 May 1947 and accepted 22 May, provided for an increase in XF-92 funds from $5,300,000 to $7,142,586.29.[27]
>
> Amendment 20, dated 24 February 1948 and accepted 9 June, provided for a further increase in funds from $7,142,586.29 to $7,292,586.29. The latter increase covered procurement of spare parts in the amount of $150,000.[63]
>
> Amendment 4, dated 7 November 1946 and accepted 9 November, provided that the contractor conduct a flight test program before delivery of the airplanes to the Government, and the first revision of Exhibit "A" to the letter contract

was made at this time. In addition to the extensive model program and detailed engineering data, the contractor was to produce two tactical airplanes, one full-size flying model designated Model 7002, and one full-scale mock-up. The full-scale flying model replaced the "skeleton" static test article. The test program which was set up for this model was to be carried out at Ames Aeronautical Laboratory, Moffett Field, prior to the initial flight tests. In connection with the full-scale mock-up, a preliminary cockpit mock-up was to be constructed for study purposes.[16]

Amendment 14, dated 21 October 1947 and accepted 5 November, contained a second revision of Exhibit "A." This revision affected the small-scale and power plant research model programs, and specified the laboratories to be used in these programs. The flight test program for the full-scale flying model mentioned above was to include 75 flying hours.[46]

Amendment 17, dated 25 November 1947 and accepted 1 December, permitted the contractor to conduct at Muroc Army Air Field the flight tests required for the two tactical airplanes and the full-scale flying model (7002).[54]

Contract W33-038 ac-20061

Soon after the XF-92 began to materialize as a delta wing plane, it became apparent that two major experimental features were involved—the delta wing and the rocket power plant installation. Accordingly, when the contractual provisions were revised by Amendment 4, dated 7 November 1946, substituting a flying model for the static test model, the aerodynamic problems were automatically separated from the power plant problems. Procurement of the rocket power plants for the XF-92, however, was delayed because of the financial condition of Reaction Motors, Incorporated, New Jersey, the company from which they were to be procured. In January 1947 Purchase Request No. 18731 for $90,000

was initiated. It provided for a program intended to develop the necessary rocket power plants and specified Reaction Motors as a sole source.

The Power Plant Laboratory, Engineering Division, recommended this company because it was the leading liquid oxygen rocket engine manufacturer, having had three and one-half years' experience with liquid oxygen. In addition, Reaction Motors was developing a rocket engine under a subcontract with Consolidated and had already developed a successful engine for the XS-1 plane. Rocket engines for the XF-92 were to be similar to those used in the XS-1 plane. The Power Plant Laboratory believed that Reaction Motors was the only rocket engine contractor that could deliver the engines in time to meet the XF-92 airplane schedule.[33]

Procurement Division rejected the purchase request because Reaction Motors was financially unstable,[34,36] and it was later canceled in July 1947.[66] An investigation by the Engineering Division, however, disclosed that the company was Navy-supported and that the Navy would exert every effort to protect its tremendous "investment and technical knowledge in this company."[33]

In August, Purchase Request No. 18953 in the amount of $90,000 was initiated to replace Purchase Request No. 18731. Two months later a third purchase request, No. 18961, for $400,000 was initiated to cover additional contemplated work. In January 1948 the contractor submitted a proposal covering Purchase Requests 18953 and 18961.[66]

A result of these somewhat complex negotiations was Cost-Plus-A-Fixed-Fee Contract W33-038 ac-20061, dated 26 February 1948. The estimated cost of the rocket engine development and procurement program provided for in this contract was $774,610, plus a fixed fee of $50,350, totaling $824,960.*

Project Justification

In July 1947 Brigadier General D. L. Putt, Deputy Chief, Engineering Division, had orally requested that the project officer prepare a review and justification of the XF-92 project. General Putt's request was based upon the fact that the Power Plant Laboratory was dissatisfied with the progress of the project, mainly because of the uncertainty of the power plant development.** The resultant justification[40] presented the following points: the interceptor type fighter aircraft is the logical vehicle to explore the practicability of higher speeds for tactical aircraft; the XF-92 was the only delta wing under development; and such a configuration was believed to be best suited to interception aircraft and guided missiles operating in the transonic range. The justification also noted that both the AAF and the Navy were sponsoring rocket engine development and rocket testing facilities, thus presupposing the application of rocket propulsion to aircraft. The XF-92 was to be

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* Contr. W33-038 ac-20061 (R), Contr. Files, Area B.
** Interview with W. R. Rankin, 10 Aug. 1948.

rocket propelled. Sooner or later the problems inherent in this project would have to be solved. Further, the justification mentioned that the von Karman Committee* had commented favorably upon the fact that provisions for delta wing development were included in the Research and Development Program for 1947 and 1948.

Upon the basis of the above justification the project was continued.[43] During August 1947 the Aircraft and Weapons Board decided that no interceptor fighter would be procured and that only experimental quantities of the XF-92 plane would be completed. These were to be used for research purposes.[91]

Meanwhile, the project had gone forward in accordance with the original letter contract and amendments thereto. Consolidated began a study and re-evaluation of the program in the spring of 1948 with the hope that a definitive contract would be formulated soon.

Project Termination

At this time the contract stated that the design of the XF-92 had reached a point where it would "not be economically sound" to continue work on the plane unless the power plant installation to be used was definitely known. The USAF contract, W33-038 ac-20061, with Reaction Motors for the development of 16,000-pound rocket power plants carried an approximate delivery date of September 1949.

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* The Scientific Advisory Board (sometimes referred to as the von Karman Committee) evaluates, on a basis of scientific knowledge, the adequacy of USAF research and development programs. The board functions as an advisory committee to the C/S, USAF.

Because this date was 10 months later than the scheduled delivery date for the airplane, Consolidated would be forced either to build an airplane without power plants or to stop the program until the power plants became available. Use of the XLR-11-RM-5 engine, with modifications, was suggested as an alternative. This power plant had already been manufactured by Reaction Motors for the XS-1 plane and could be delivered much sooner. Of the two power plants under consideration, the RM-5 engine would cost less, but the contractor stated that "there [would] be a substantial increase in the total cost of the program with either of the power plant installations."[78]

In June 1948 the Director of Research and Development, AMC, recommended to the Deputy Chief of Staff, Materiel, Washington, that the project be partially terminated and described it as representing a series of research and development efforts of major components rather than a single, complete airplane project. Approximately $3,400,000 had been spent in accomplishing the configuration. Most of this amount had been spent on wind tunnel testing and designing and on building the flying prototype (Model 7002). Since the formulation of the letter contract the estimated cost of the project had been boosted to $16,243,000, and the many features as yet undeveloped would add still more to the cost. The Director, Research and Development, therefore emphasized the fact that $16,243,000 did not represent the total end cost of the project. Accordingly, the AMC recommended that the two XF-92 tactical planes

provided for in Item 1 of the letter contract be canceled, but that any work pertinent to the flying prototype, Model 7002, be continued.[90,93] The NACA was also advised of the cancellation and was requested to review its program in connection with the XF-92.[95] On 5 August the Los Angeles Procurement Field Office was officially notified of the termination and was instructed to proceed accordingly.[97]

The contractor, Consolidated Vultee, expected to continue the program approximately as follows: (1) work on the flying mock-up with emphasis on the development of a configuration which would utilize a turbo-jet propulsion system; (2) continue basic research on the ducted-rocket-ram-jet version of a propulsion system; and (3) continue development of the Offenhauser auxiliary power unit. Some aerodynamic research was to be conducted in connection with the XF-92 tactical plane.[89,90]

The AMC requested Consolidated to submit a quotation for the remainder of the project, upon which a definitive contract was to be formulated. By December, two quotations had been submitted. Both were refused by the AMC; the first, because it was "inadequate"; the second, because it was "unrealistic." A third quotation, submitted late in December, was accepted as a basis for negotiations. In this quotation the estimated cost, plus a fixed fee for the total contract was $4,686,192.99. The Procurement Division, AMC, requested Consolidated to reduce or to justify the estimated cost figure, but reductions in labor hours for the flying mock-up, in the flight test

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program, and in experimental labor only brought the estimate down to $4,274,129.62—a figure still unacceptable to the AMC. When the AMC suggested that "settlement for the continuing portion of the procurement should be made on the basis of the estimated cost and fixed fee rate originally negotiated," a discussion arose as to who had made what changes, and how much those changes had increased the cost of the project. (Ordinarily, such changes would have been made official by change orders.) The final decision was that the original estimate would not be increased because of engineering design changes.[101]

The Engineering Division, AMC, estimated that approximately 25 per cent of the terminated portion of the contract had been completed prior to the termination at an estimated cost of $1,087,322. The total estimated cost of the contract, which included both work performed and continuing work, was $3,767,005.95. The total amount of fixed fee negotiated was $195,884.31, or 5.2 per cent of the estimated cost. In addition, an over-run of $579,178.05 was allowed by the AMC, but no fee was paid for this amount.[101] In summary, the cost of the work, both performed and continuing ($3,767,005.95), plus the fixed fee ($195,884.31), plus the over-run ($579,178.05) amounted to $4,542,068.31, the total estimated cost of the contract.[101]

As of March 1949 the revised XF-92 program included the following items: (1) flying mock-up and flight test program for the flying mock-up; (2) power plant research and development program; (3) aerodynamic

research program; (4) engineering data; (5) one tactical mock-up; 101
and (6) the portion of the tactical plane which was not terminated.

IV. ENGINEERING

Model Program

In the summer and fall of 1946 conferences were held to determine a suitable model program for the XF-92. The conferences were attended by AMC and NACA personnel, Consolidated Vultee engineers, and representatives from Reaction Motors, the company which was to supply the rocket engines for the XF-92 power plant. Research data on ducted rocket power plants were nonexistent, and data relative to supersonic aircraft were limited. In the course of the preliminary conferences, personnel from NACA agencies stated that they would be "more than willing" to conduct tests on the 60° delta wing configuration of the XF-92.[14] Further, the NACA believed that the configuration of this plane was the logical approach to problems of supersonic flight.[15]

Since the XF-92 project involved fundamental aerodynamic problems, the over-all program of the XF-92 was believed to be an "excellent means for clarifying and defining the aerodynamic problems" connected with supersonic aircraft of the XF-92 type through all speeds of flight.[16] For example, the main objective of the general supersonic research program of the Ames Laboratory was to investigate the characteristics of low-aspect-ratio triangular wings throughout the speed range possible to their laboratory facilities. Therefore, Ames wanted to incorporate the full-scale low speed tests of the XF-92

configuration in the research program on triangular wings.[25]

At this time the AAF was putting a great deal of emphasis on development of the XF-92 and therefore desired to utilize its configuration in as many ways as possible. It was hoped that the various types of wind tunnel testing and research could be carried on by NACA agencies and that the resultant information could be distributed by the NACA to contractors engaged in similar projects.[24]

Items 2-9 of the original letter contract[9] provided for the model program. As the research work continued, however, and as the various agencies considered it necessary to add or delete certain models, the original program was revised and enlarged. Although most of these changes are apparent in the amendments to the letter contract, the amendments do not present a complete record since the cut-and-try nature of the entire project was not always adaptable to contractual terms. By June 1948 the model program had progressed to the point where it could be summarized and presented as a firm program. At that time the contractor submitted a revised statement of work* which set forth the model program in full. The program had been enlarged to include Items 2-14 of Exhibit "A" to the contract.

The models may be grouped into two categories—aerodynamic and power plant. The aerodynamic model programs proposed or studied include the following:

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* Ltr., CVAC to CG, AMC, 3 June 1948 (C), Fighter Br. files.

Full-scale Flying Model (Model 7002)

This model was flight tested at Muroc Air Base. Prior to the initial flight it was tested in the full-scale (40' x 80') wind tunnel at Ames Aeronautical Laboratory, Moffett Field. The 40' x 80' wind tunnel tests were to determine the low speed flight characteristics of the plane.

Wing Plan Form Configuration Study

This study involved the construction of several wings of various plan forms. The model wings were tested for low speed stability and control characteristics. The tests were conducted in the contractor's 4' wind tunnel and in the GALCIT* Wind Tunnel.

1/12 Scale Model Test Program

The construction of the 1/12 scale model was based upon information obtained from the wing plan form study. The purpose of the program was to determine the over-all low speed stability and control characteristics of the complete airplane configuration without the internal duct. The tests were conducted in the GALCIT Wind Tunnel. Tests were also run using a 45° wing as well as a 60° wing in order to be sure that the 60° configuration was superior.[17,19]

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* GALCIT, the Guggenheim Aero. Lab., California Institute of Technology.

High-Speed Wind Tunnel Program

A 1/40 scale, half-span model and suitable mounting were constructed for dynamic and static tests in the CIT Co-op Tunnel.* The "Bump" technique was used in the Co-op Tunnel for force tests, and tests were also run in the Daingerfield, Texas, facilities. Earlier in the program the 1/32 scale was tested.

1/64 Scale Supersonic Wind-Tunnel Model Program

Originally, the supersonic models were to be 1/60 scale, but the size was necessarily changed.[17] Enough models of the 1/64 scale size were constructed by the contractor for 43 test runs.[22] Because the elevators on the models were stationary, a separate model was required for each elevator configuration.[20a] The tests were conducted in the Ames Laboratory 1' x 3' supersonic[21] and the 1' x 3 1/2' transonic wind tunnels.** The purpose of the tests was to determine aerodynamic characteristics at the design speed.[18]

Transonic Rocket Powered Models

NACA and Consolidated Vultee engineers agreed early in the XF-92 program that their "most serious aerodynamic problem would be that of transonic control."[18] Accordingly, the contractor built six

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* California Institute of Technology.
** Interview with W. R. Rankin, 21 Jan. 1949.

1/6 scale models. The NACA conducted the testing of these models at Langley Field, where the rocket power plants and all instrumentation were installed. The purpose of the tests was to study the aerodynamic and control characteristics of the XF-92 configuration through the transonic range.

Spin Model

This model was built by Consolidated to conform to requirements set up by the NACA and was tested in the Langley Free-Spin Wind Tunnel.* 24 The model was a 1/12 scale of the flying mock-up.

Free-Flight Model Test Program

The free-flight model was designed and tested by the NACA Free-Flight Tunnel at Langley Field. The model was a 1/12 scale model of the 7002 flying mock-up. The tests provided data on stability and control characteristics of the 7002 configuration.[57]

Full-scale Test Model Take-off Cart

The model take-off cart was to be constructed and tested by the contractor. The purpose of this model was to determine operating features of the cart and to check its controls at various speeds. A body similar

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* Ibid.

to the XF-92 configuration was to provide ballast and propel the combination.

The power plant model programs proposed or studied include the following:

Duct Test Program

The contractor was to furnish a full-scale model of the ducted rocket power plant. The program was set up to utilize the contractor's facilities and the facilities at Daingerfield, Texas.

Reduced Scale Power Plant Research Program

Three test programs were to be conducted on reduced scale power plants. Two of them were carried out at the contractor's plant—one using a 3,000 cubic foot per minute air supply, the other using a 15,000 cubic foot per minute air supply. The third program was conducted at the facilities of the NACA Power Plant Wind Tunnel at Cleveland.

In general, the power plant research programs were favored by the Aircraft Engine Research Laboratory[12] as a means of providing basic research for the proposed ducted rocket propulsion system. The XF-92 model program, which began in 1946, continued active until May 1947, by which time the bulk of the work had been completed

and the program had begun to taper off.* By the fall of 1948 the contractor and the various testing facilities were submitting reports containing the data resulting from the model programs.** It was expected that the NACA would retain the models, both aerodynamic and power plant, for any desirable future research or test by its laboratories. In November 1948, however, the NACA stated that it did not consider the XF-92 to be a representative supersonic aircraft configuration because the diameter of the fuselage was large compared to the wing span.*

XF-92 Tactical Plane

Although no XF-92 tactical aircraft was produced, a great amount of time and money was spent in exploring the possibilities of its development. Therefore it appears advisable to describe in detail the XF-92 tactical aircraft as Consolidated proposed to build it, had that portion of the contract not been terminated. The experimentation in aerodynamics by the model program determined the external configuration of Model 7002 and the tactical craft. As opposed to the conventionally-propelled flying prototype, the tactical craft incorporated numerous novel design features in method of

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* Except where otherwise indicated by citations to documents, information relative to the model program has been taken from the statement of work submitted 3 June 1948 by the contractor. Detailed model program data are also available in file, "Project MX-613," section on NACA (C), Classified CF-B.

** XF-92 file (C), Fighter Br. files.

propulsion, pilot escape, and take-off in order to attain the high performance specified. A detailed description of the XF-92 design follows.

The XF-92 spike diffuser fuselage is of an all-metal, semi-monocoque stressed skin construction. A cylindrical outer shell encloses an inner body; the shape of the inner body conforms to expansion requirements for the ram jet. A framework of longitudinal stringers and bulkhead rings provides structural strength and stiffening. Removable panels are provided for access to power plants, communications system, and miscellaneous electrical and hydraulic systems. The fuselage is made up of three sections: the capsule section containing the pilot's compartment; the middle section housing the rocket engines, their fuel system, and the accessory power unit; and the aft section, which is built of corrosion-resistant steel and is the burning chamber for the ram jet fuel.*

The XF-92 spike diffuser fuselage is 80 inches in diameter and has no external cockpit enclosure, whereas Model 7002 has a conventional fuselage 66 inches in diameter with an external cockpit. The wing area of both planes is 425 square feet. The vertical tail area (52 square feet) is smaller than that of the 7002, but both have a 60° sweptback leading edge.[71] The tail of the XF-92 is all-movable; that of the 7002 is the conventional rudder and fixed fin. The

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* Model Spec., 2 Apr. 1948 (C), Fighter Br. files.

change in XF-92 design to a movable tail was made in the spring of 1947, and it was estimated that the weight saving effected by the change would be 100 pounds.[31]

The tactical plane was to carry two external, droppable fuel tanks. In addition, lox* and gasoline for use after take-off was to be carried in wing and fuselage inner-body tanks. The plane was to be armed with four Model T-31 20 mm automatic guns, carrying a total of 624 rounds of ammunition, and the armament installation also included an A-1A gunsight and a type AN-N6 gun camera.**

The wing is an all-metal, multi-spar, full-cantilever delta configuration with a leading edge sweepback of 60°. It houses fuel cells and main landing gear when in retracted position. Full span elevons of constant chord, located at the wing trailing edge, act as ailerons or elevators. Flight control surfaces are actuated by means of a hydraulic boost system designed to be irreversible, thus eliminating surface control load feedback to the pilot. An electrically operated artificial "feel" device controlled by the airplane speed provides the pilot with normal "feel" of the flight control.**

Because of the extremely experimental nature of the XF-92, frequent changes in planning and design were necessary, particularly in regard to the power plant installation since no previous research had been conducted on ducted rocket power plants. The proposed

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* Lox-liquid oxygen.
** XF-92 Airplane Mock-up Book, Apr. 1948 (C), Fighter Br. files.

propulsion system of the XF-92 consisted of ducted rockets as well as an aircraft gas turbine and a normal rocket installation. The original design was powered by fifteen 50-pound thrust rocket engines, mounted in a duct, which were to act as flame holders for a ram jet power plant for high speeds by injecting fuel into the duct aft of the rocket engines. The 50-pound thrust rockets forming the ram jet were to be enclosed in the body of the airplane, which was shaped as a duct for operation on the ram jet principle. Four 1,500-pound thrust rocket engines, arranged around the outside of the ram jet duct, were to assist in take-off, climb to 50,000 feet, and acceleration. A Westinghouse 19XB turbo-jet engine was to drive the accessories and to provide power for landing when rocket and ram jet fuel was exhausted.[39] The first model specification, forwarded to the AMC in September 1946, indicated that the Westinghouse 19XB engine was to be replaced by a 24C engine in order to obtain more power for landing approaches and accessory drives and to function in pressurizing the cabin. The 24C engine was to be installed in the center portion of the fuselage structure by three point suspension.*

In March design study was begun on a "spike" or "Ferri" type diffuser for use in the XF-92.** It was to be an oblique shock supersonic diffuser having a 50° cone angle. (The size of the XF-92

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* Manufacturer's Model Spec. MCVF 622, 25 Sept. 1946 (C), Fighter Br. files.

** This type diffuser was designed and tested by A. Ferri of NACA.

diffuser was established by the requirement that it house the pilot's compartment.)* The design resembled a large ram jet engine with the pilot enclosed in a cockpit in the center of the annular duct. The inclusion of the spike diffuser in the plane design was a radical departure from conventional type fighters, but it was believed to be the solution to many problems.** During the same month the power plant was again revised when the 1,500-pound thrust take-off and climb rockets were increased to 2,250-pound thrust. This was necessary in order to reduce the time required to climb to 50,000 feet. The 2,250-pound thrust liquid fuel, unducted rockets were to provide high power short period operation in climbing and level flight supersonic operation.***

The efficiency of the auxiliary turbo-jet engine was also being investigated at that time. After extensive research, the AAC and the contractor concluded that the 24C engine should be eliminated altogether for several reasons: It appeared doubtful that the 24C could be operated successfully at 50,000 feet, and operation of the engine above 35,000 feet for driving the accessories was questionable; The thrust produced by the 24C was not considered adequate to fly the plane without rocket assistance; An entirely separate fuel system

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* CVAC Monthly Activity Rpt., Mar. 1947, p. 17 (S), Fighter Br. files.

** Engineering Div. Weekly Rpt., 18 Apr. 1947 (S), AAC Hist. Office files.

*** CVAC Monthly Activity Rpt., Mar. 1947, p. 2 (C).

would have to be incorporated for the gasoline burned by the 24C unit. (In order to simplify the fuel system of the entire plane, it was desirable for the rockets, ram jet, and auxiliary power unit to operate on the same fuel.) Service and maintenance problems, including an oil system, tank, cooler and plumbing, and a separate ignition system would be added. Even the fuselage structure would be complicated by the necessary installation of added doors to provide access to the 24C unit.*

In May 1947 the contractor submitted a proposal to use a 120 hp gasoline engine for driving the accessories in lieu of the 24C.** On the basis of reciprocating type auxiliary power plant studies made on the investigation of a liquid-cooled engine, the 240-L Jacobs engine appeared suitable.[29] However, information on that unit was not available, and the study was shortly discontinued in favor of a study on the Offenhauser 97 cubic inch engine.[31]

During the summer of 1947 the Consolidated plant was moved in its entirety from the Vultee Division location at Downey, California, to San Diego.[28,42] It is reasonable to assume that the resultant delay and confusion[32] attending such a large-scale move accounts for the scarcity of documentary material available for that period.[26] The fact that no monthly activity reports were received by the AMC

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* XP-92 Configuration Study Summary, DLVF 3025, 28 Mar. 1947, p. 67 (S), Fighter Br. files.
** Eng. Div. Weekly Rpt., 23 May 1947 (S), AMC Hist. Office files.

from April to September makes impossible a detailed account of power plant work accomplished during that time.

The November report indicated these over-all changes in the ducted-rocket-ram-jet installation: (1) Sixteen 50-pound thrust rockets were to be used as flame-holders; (2) Three 4,000-pound thrust rockets were to assist in take-off, climb, and acceleration to supersonic speeds; (3) The liquid-cooled Offenhauser 120 hp engine was the auxiliary power unit.* Four fuel injection rings were to encircle each rocket chamber and inject additional fuel into the duct airflow where it was burned. In this operation the rocket engines would act as pilot burners and produce a small amount of thrust by themselves.** Use of the larger rocket power plant system was similar to that proposed for the XF-91 plane built by Republic Aviation.[70]

No further change was made in the power plant until April 1948 when the three 4,000-pound thrust rockets were increased to four. The 4,000-pound thrust rockets were to be placed adjacent to the trailing edge of the wing rather than inside the duct because "the power in the noise was so great that resonant stresses in the duct itself were intolerable."[68] A separate gas-lox*** rocket turbine

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* CVAC Monthly Activity Rpt., Nov. 1947, p. 9 (C), Fighter Br. files.
** CVAC Monthly Activity Rpt., Dec. 1947, p. 6 (C).
*** Gasoline-liquid oxygen.

was to be used to drive the 4,000-pound thrust rocket fuel pumps.* After a mock-up conference on the XF-92, the Maintenance Division, AMC, expressed the opinion that the contractor had made much progress on rocket cylinder design, "especially from an operational and maintenance viewpoint."[75] The power plant arrangement described above was set forth in the latest available model specification.* A summary of the advantages of the type of power plant proposed for the XF-92 was sent to the AMC by the contractor in June 1948.[76]

The method of take-off proposed for the XF-92 tactical craft also presents a radical departure from conventional design. The four-wheel, H-shaped take-off cart, which is not an integral part of the plane, was designed to support the plane during ground handling, taxiing, and take-off. The cart also provides fuel for the ram jet and rocket engines during take-off. The cart acts as an auxiliary gear, providing savings in space and weight which would normally be required for a landing gear capable of carrying the heavy take-off loads necessary for this plane. The following description is a condensation of the Consolidated specification for the cart.**

The H-shaped chassis is designed to be of steel monocoque structure. Its over-all dimensions are as follows: length, 25 feet 6 inches; width, 14 feet; height, with supports extended,

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* Model Spec. for XF-92, 2 Apr. 1948 (C), Fighter Br. files.
** Rpt. No. ZM-115-003, Detail Spec. for take-off cart, 2 Apr. 1948 (C), Fighter Br. files.

11 feet 10 inches. Take-off fuel is stored in the center portion which includes pressure bulkheads. The pneumatic, hydraulic, and electrical equipment is housed in a cowl assembly above the upper portion of the monocoque structure. The two structural shells are connected by a structural airfoil section. One of the shells serves as a tank for the airplane fuel; the other, for liquid oxygen. A third tank, located in the center of the lox tank, contains the helium required to force the fuels under pressure to the plane. Separation of the plane and the cart would automatically disconnect the fuel lines. Each of the two rear chassis end assemblies has a fixed stabilizing fin.

The plane was to be supported by a welded tube structure on the cart which attached to the wing of the plane by four fittings. The fittings were designed to prevent release of the plane until an angle of attack (approximately 16°) was reached. The airplane support structure was to be retractable so that the cart could be moved into position beneath the plane. Actuating cylinders would then extend the structure and hoist the plane to take-off level by hydraulic pressure. When the plane had assumed take-off angle, the cart would be automatically disengaged and the supporting structure retracted. Each of the four sets of dual wheels was to be equipped with brakes. The brakes could be operated by the pilot during the take-off run, but they would be automatically applied when the supporting structure had reached a certain predetermined point of retraction. The cart

design includes provisions for a tow bar to facilitate ground handling with or without the plane.

In the spring of 1946 the contractor proposed to build a ground test plane and a test cart for use with it. Although the test units were to be constructed as cheaply as possible, they were to accurately simulate the final plane and cart in regard to directional characteristics and to assist in determining the practicability of the take-off method.[67]

Prior to the XF-92 the pilot emergency escape procedure had the never actually been incorporated in a plane design. It involves a jettionable capsule housing the pilot's single-place compartment in the forward part of the fuselage. The pilot's cabin is to be automatically pressurized by a tank containing approximately 60 pounds of liquid oxygen-nitrogen, which also cools the cockpit after first passing through a heat exchanger. (It was expected that ram air would be used at lower altitudes to conserve the liquid oxygen supply.) Bail-out procedure at high speeds or high altitudes was to be preceded by capsule ejection.

The capsule section was designed to break away as a complete unit in an emergency. Accordingly, the plane design provided that fuel would be dumped at extremely high speeds in order to hasten deceleration to a speed suitable for releasing the capsule. A door covering the stored capsule chute was to fall free and the chute would be self-ejecting. The chute was to be connected to the capsule

by a belt extending along the aft side of the capsule bulkhead and attached near the top of it. After ejection and opening, the pull on the chute belt would operate the capsule release mechanism, freeing that section by pneumatic disconnects from the rest of the plane. Pressure in the cockpit section at the time of release was to be retained during the capsule descent. In falling, the capsule was to be stablized by its ribbon parachute until it had reached an altitude which did not necessitate provisions for pressurization and oxygen. (The contractor believed that the maximum speed for release of the chute and capsule would be 450 mph indicated air speed and that a terminal velocity of approximately 200 mph indicated air speed would be reached by the capsule-chute combination if a 5-foot diameter ribbon chute was used.)[65] The pilot would then bail out of the capsule through a normal exit in the top of the windshield canopy. He would be equipped with an oxygen mask and a small bail-out oxygen bottle for emergency purposes.

Performance figures for the XF-92 can only be estimated since the plane is in the mock-up stage. The following performance figures are reproduced below in excerpt form from the model specification of 2 April 1948. All performance listed is for combat gross weight, and without external fuel tanks except as noted.

E-1a. <u>Performance Item:</u>

High Speed - at sea level . . . . . 521 knots (600 mph, Mach No.-.785)

at 50,000 ft for
condition A . . . . . 547 knots
(630 mph, Mach No.-.95)

at 50,000 ft for
condition B . . . . . 1012 knots
(1165 mph, Mach No.-1.75)

Time to climb (with external tanks)
to 50,000 ft from start of take-off run . . . . 4 minutes

Cruising speed at 50,000 ft
(External tanks off) . . . . . 547 knots
(630 mph, Mach No.-.95)

Endurance at 50,000 ft (external tanks off):

Condition A - Cruise at 547 knots (630 mph)
with 5 minutes reserve fuel for cruise at
217 knots (250 mph) at sea level before
landing . . . . . 24.7 minutes

Condition B - Accelerate from 521 knots
(600 mph) to 1012 knots (1165 mph, Mach
No.-1.75) and cruising at 1012 knots
(1165 mph, Mach No.-1.75) and leaving
5 minutes reserve fuel for cruise at 217
knots (250 mph) at sea level before
landing . . . . . 5.4 minutes

E-1a (1) Additional Performance - None

E-1a (2) Performance Curves See Figure 3

E-1a (3) The following estimated specific fuel consumption applies to the rocket motors and to the estimated performance stated herein.

External rocket motor, specific impulse - 215 seconds
Internal rocket motor, specific impulse - 160 seconds
Propellant consumption for external rocket pumps
2 lb/sec at full thrust

Item 14 of the letter contract provided for a full-scale mock-up of the XF-92 tactical craft. In the early months of the project it was expected that the mock-up inspection would be held in January

or February of 1947,* but the work was not completed until the spring of 1948. The inspection was held 20-23 April 1948 at the Consolidated Vultee plant at San Diego, California. The project officer reported the mock-up as complete and well-presented. It was attended by a mock-up board made up of committee members, technical advisors, and observers. All internal equipment was installed on the mock-up, and provisions were made to separate the capsule from the rest of the mock-up fuselage in the same manner that was to be used on the actual plane. A one-eighth scale model of the plane and take-off cart and a mock-up of the droppable wing tank were also available. In addition, the auxiliary power plant was mocked-up separately from the plane. The technical advisors submitted their comments to the mock-up committee for review, and those comments which were approved by the committee were passed on to the contractor. Although many suggestions for changes were submitted and approved, none were believed to involve price increases.** The Flight Test Division, AMC, was represented by Major G. Lundquist and Captain J. T. Fitzgerald, who made several recommendations and comments, particularly in reference to the cockpit, take-off cart, rate of roll, flight controls, and instrument panel. At that time Major Lundquist stated, ". . . practically all of our suggestions

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* Eng. Div. Weekly Rpt., 26 July 1946 (C), AMC Hist. Office files.
** Eng. Div. Memo Rpt. No. MCREOA -4-1421, "Mock-Up Insp. of Consolidated Vultee XP-92 Airplane," 19 May 1948, pp. 3-4 (C), Fighter Br. files.

were disapproved by the mock-up committee. Captain Fitzgerald and I feel that the airplane in its present configuration is highly impractical, especially for any use other than as a research aircraft. . ."[76] The comments in question were considered and later were replied to by the project engineer, to the effect that no action would be taken by the mock-up committee.[80]

Model 7002 Flying Mock-up

Model 7002,* or 46-682,[53] the full-scale flying mock-up of the XF-92, was provided for in Item II of Amendment 4 to the letter contract.[16] This model was to conform as nearly as possible to the external configuration of the actual plane. It was to be constructed in the "shortest possible time," and parts from available stocks and other planes were to be used extensively. No AAF specifications were applicable to the 7002,[16] and none of the usual drawings or test records—with the exception of flight test reports—were required of the contractor. The purpose of Model 7002 was to investigate the handling and aerodynamic characteristics of the 60° delta wing configuration. Approximately 1,554 pounds of flight test equipment was specified for installation in the plane.**

The over-all construction of the fuselage is the same as that of the XF-92, except that an external, single-place cockpit is located

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* Consolidated Vultee designation. There is no AF designation for this plane, but an AF serial No. (46-682) was assigned.

** Rpt. No. DEVF 624, Model Spec. for Consolidated Vultee Model 7002, 13 Aug. 1948 (C), Fighter Br. files.

in the upper forward section. According to the model specification* the cockpit canopy is raised by compression springs for normal entrance and exit. Jettisoning of the canopy for emergency escape is possible when the canopy is in an approximately vertical position. For future testing the present Model 7002 nose assembly may be replaced by a spike diffuser, based on XF-92 lines, in order to simulate more closely the tactical plane.

The 7002 wing is a delta configuration with a 60° sweepback on the leading edge. It is of two-spar, full cantilever, all aluminum alloy construction. Elevons extend the full length of the wing trailing edge. Surface control is maintained by a single push-pull rod system. The vertical tail of the plane has an area of 59.9 square feet, or 7 square feet more than that of the XF-92. The dimensions of the 7002 are as follows: length, 41 feet 6 inches; height, 16 feet 6 inches; span, 29 feet 5 inches. Estimated weights are as follows: useful load, 4,522 pounds; weight empty, 9,078 pounds;** gross weight, 13,600 pounds.

The hydraulically-operated landing gear is tricycle type and is retractable. Parts from the P-63 plane are used for the nose gear.

Pilot emergency escape provisions include a catapult ejection seat very similar to that used on the YP-81 plane.

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* Ibid.

** Complete tables of weights and dimensions are to be found in the Model Spec. for Model 7002, 13 Aug. 1948 (C), pp. 5-7.

The power plant installed in Model 7002 was a conventional Allison turbo-jet engine. Although a J33-23 engine was installed for flight testing, other jet engines had been considered for use in the plane. The J33-17 engine was specified for the 7002 in Amendment 4, dated 7 November 1946. In December 1946 the engines were ordered from Bell Aircraft, but since they were not available the J33-11 engine was suggested. However, the J33-11 engine was not considered adequate for high speed tests, and the contractor planned to use it for low speed tests.[23] Data on the 1/12 scale wind tunnel model had indicated that there was not enough margin between the thrust available and that required for safe operation. The J33-21 engine, which was available at the time, was also analyzed, with the conclusion that use of this engine would place too much dependence on JATO during take-off.[51] For these reasons Consolidated requested authority from the AMC to replace the J33-11 with the J33-23 engine—a 34 vane impeller engine without any restrictions. However, the J33-21 engine with water injection was installed by Consolidated in January 1948. At this time the contractor mentioned the possibility of converting the 7002 to a tactical plane by installing the J33-23 engine with after-burning. The contractor also wished to design and manufacture parts to accommodate the J33-23 engine and to install the water injection system being furnished by Lockheed in the P-80B planes. Use of water injection with that engine decreases the length of the take-off run from 4,300 feet to

3,400 feet and increases the rate of climb.[72] Although the first power plant installation did not include JATO units, provisions were made for them.[7] The units will be the standard 12 AS-1000 type.[58]

The fuel system of the 7002 consists of a non-self-sealing fuel tank located within the fuselage, with a capacity of 300 gallons of JP-1 fuel. A ninety-gallon tank for water-alcohol is to be installed to the rear of the fuel tank.

The estimated performance figures are reproduced below in excerpt form from the model specification.* The figures are based on a gross weight of 13,000 pounds, except as noted below, a 425-foot wing area, and 4,600-pound static thrust without water injection and 5,400-pound static thrust with water injection.

E-1a. Performance

	Without Water Injection	With Water Injection
High Speed:		
At sea level - MPH	514	552
At 30,000 ft - MPH	598	631
Time to climb to 30,000 ft - MIN	12.9	- -
Endurance at 20,000 at cruising at maximum continuous power with allowances in fuel for warm-up and take-off (2 min), climb to altitude, and reserve fuel for 5 min flight at sea level at military power (300 gal. total fuel, take-off gross weight=13,600 lb) MIN	18	- -

* Rpt. No. DEVF 624, Model Spec. for Model 7002, 13 Aug. 1948, p. 4 (C).

Take-off ground run at sea level (gross wt=13,000 lb) - FT.	5000	3000

Preliminary design studies on the flying mock-up were begun in the fall of 1946.[11] The wing area of this plane was to be larger than that of the XF-92 tactical design. The 7002 was to be tested in the 40' x 80' full-scale wind tunnel at the Ames Aeronautical Laboratory at Moffett Field to investigate low speed problems of the delta wing configuration. The initial flight date was first set for July 1947. By April the plane was essentially complete except for liaison and modifications. The plane was scheduled for completion in August 1947, and the initial flight date was changed to September.[37] Actually, the 7002 was not completed until 4 November. The plane was at the Consolidated Vultee plant at San Diego, where it was built, and the problem was to move it from San Diego to the Ames Laboratory at Moffett Field for the full-scale wind tunnel testing.

The Deputy Chief of Staff, Materiel (Washington), had requested that every effort be made to avoid compromise of the XF-92 project classification.[48] In accordance with this request, all security measures were observed and the move was carried out with the utmost secrecy. The plane was boxed and completely covered with tarpaulin. It was hauled by trailer under military escort along back roads to the Navy dock. There it was loaded onto a Navy transport which departed for San Francisco the same day.[50] The transport carried

it to the Oakland port, and from there it was again moved by van to the laboratory at Moffett Field on 6 November.[49,52] Meanwhile, serial number 46-662 was assigned to the plane.[53] Tests in the full-scale tunnel at Moffett were completed in December and the plane was returned to San Diego. The results of the tests were better than had been expected and indicated that the endurance of the XF-92 might be improved.[58]

At the Consolidated plant the J33-21 engine with water injection was installed. The J33-21 engine was to be used for the taxi tests, although the contractor had been requesting delivery of J-23 engines for the testing.[51,55] In January (1948) Consolidated had requested authority to conduct the 7002 taxi tests at Lindbergh Field, San Diego. Permission was refused, however, on the grounds that measures for security at that field were inadequate. Further, the AMC stated that no press releases were to be made at that time.[60] The taxi runs were scheduled for the middle of March, and two Consolidated pilots with XB-46 experience were chosen by the contractor and approved by the AMC. A discussion of insurance for the test pilots was underway. The contractor proposed procurement of an insurance policy to the extent of $100,000 which would cover either of the approved pilots while in flight. Lloyd's of London was willing to issue the policy for a premium of $[illegible],414.55.[64] The AMC concurred,[66] and the insurance was considered an allowable item of cost for flight testing under the contract.[69] The test program was delayed, however, because some of

the water injection parts were not available.*

The 7002 arrived at Muroc the first of April. During the move from San Diego to Muroc the same security precautions were observed as in the first move.[56] Seventeen contractor personnel, who had been assigned to Muroc for the duration of the project, assembled the plane and checked the instrumentation. Uncertainty surrounding the delivery date for the J33-23 engines prevented the planning of a flight test program, although the taxi program was not affected. Use of the J33-21 engine necessarily limited the speed range for testing.[68] The taxi runs, using the J33-21 engine, were to investigate these items: engine operation, elevon effectiveness, steering, and the air speed system. The tires were necessarily limited to ground speeds of 100-160 mph.[73] The flight program remained uncertain because of the J33-23 engine.[74,79] On 25 May the taxi tests began, and the AMC received a detailed report of the runs. Brake trouble developed, and it was noted that the right hand brake was warped.[83] A spare set of brakes was installed, and the taxi tests were resumed in June.** During these tests the top speed was 180 mph. After approximately two miles a lift-off of 10-15 feet was made and held for two miles. The elevon action was reported as "very effective," and the brake action as "satisfactory."[84]

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* Eng. Div. Weekly Rpt., 27 Feb. 1948 (S), AMC Hist. Office files.
** Eng. Div. Weekly Rpt., 10 June 1948 (S).

During this test period about fifteen taxi runs were made. The tests showed that the controls were too sensitive.

The J33-23 arrived at Muroc in the middle of June.[29] Installation of the engine and ground rework of the plane evidently entailed much more work than expected, since the initial date of taxi test using the J33-23 was moved forward from the end of June to the first of September.* ** During this period a new type high speed canopy was installed and the engine compartment was reworked.[31] The 7002 taxi tests were resumed on 15 September. The maximum indicated air speed for the two runs was 177 mph; the maximum height reached was 20 feet.** On 18 September the first actual flight, 19 minutes in duration, was made. The take-off required 4,000 feet of runway; an altitude of 12,000 feet was reached, and the indicated air speed was 305 mph. The plane took off at 180 mph and landed at 175 mph. During this flight the controls functioned satisfactorily. The second flight, of approximately the same duration as the first, was made on 29 September.*** After about five flights the plane was grounded for the contractor to install new elevons and flutter instrumentation and to make other adjustments.****

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* Eng. Div. Weekly Rpt., 17 June 1948 (S), AMC Hist. Office files.
** Eng. Div. Weekly Rpt., 17 Sept. 1948 (S).
*** Minutes of the AMC Conf., 21 Sept. 1948, Supp. Serial No. 72, p. 6 (S), AMC Hist. Office files.
**** Eng. Div. Weekly Rpt., 29 Oct. 1948 (S).

On 29 October 1948 a complete report, covering all 7002 flights up to 26 October 1948, was submitted to the AMC by the contractor. Detailed flight test memoranda are available in this report and are accompanied by performance curves and other charts.* By February 1949 Model 7002 had made approximately 19 test flights. It is expected that the flight test program for this plane will be extensive, particularly since the two tactical craft have been canceled.

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* Ltr., CVAC to CG, AMC, 29 Oct. 1948 (C), Fighter Dr. files.

V. CONCLUSION

Throughout the XF-92 project considerable interest was evidenced by agencies other than the Air Force. From the beginning of the project the NACA appeared eager to participate in many of the proposed wind tunnel test and research programs because it believed that research done on the XF-92 would materially assist in the solution of problems connected with supersonic aircraft of the XF-92 type. The NACA was requested to complete the free-flight rocket model firings as the resultant data would be applicable to the NACA research program relative to supersonic aircraft.[25]

The Navy also displayed an interest in the progress of the XF-92. In August 1947 the Bureau of Aeronautics requested that the monthly status reports from Consolidated be made available to the Navy. At that time it was believed that the XF-92 might influence directly the design of Navy fighter aircraft.[42]

In accordance with a request made by the British Supply Office for information pertinent to delta wings, the Engineering Division, ARC, forwarded all XF-92 material available. Included were many Consolidated reports, wind tunnel reports, and model specifications. In exchange for this material the Engineering Division requested aerodynamic and performance data on the Gloster delta fighter and the De Havilland Swallow.[77]

As of the closing date of this history, April 1949, the attitude of the ARC is that the XF-92 project has cost too much money. But

the Power Plant Laboratory, Engineering Division, is still actively interested in its function in the XF-92 project, which is to furnish a GFE power plant. Although the two tactical planes called for in Letter Contract W33-038 ac-14547 have been canceled, the power plant design and development work provided for in Contract W33-038 ac-20061 is continuing. Funds currently provided for this work total $124,960. The contract provides for applied research, design, fabrication, and development, but does not include an end product. The contractor, Reaction Motors, is to furnish complete designs, including component designs suitable for fabrication and development testing of a complete engine system as a unit. The major emphasis will be on the use of JP-3 fuel, and the system and its components will be designed to operate accordingly. The results obtained from Contract W33-038 ac-20061 research work on ducted rockets have already produced direct benefits and will be valuable for later work. For example, the XF-92 power plant thrust chambers are physically interchangeable with those of the XF-91. Also, the work accomplished under this contract may have direct application to assisted take-off systems.*

The extensive negotiations centered about Contract W33-038 ac-14547 since its partial termination in August 1948 have resulted in a revised statement of work and an estimated cost figure acceptable

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* Interview with Charles Tanis, Proj. Engr. for PX-902 (XF-92 power plant), Rocket Unit, Non-Rotating Engine Br., Power Plant Lab., Eng. Div., 25 Jan. 1949.

to the ANC. A final procurement report on the contract sets $4,542,068.31 as the total estimated cost. The major articles provided for in the revised program include Model 7002 and its flight testing, power plant and aerodynamic research programs, a tactical mock-up, and the portion of the tactical craft not terminated. There is still a definite need for a fighter plane capable of the high performance which had been anticipated for the XF-92.* In this connectio the possibilities of the delta configuration for fighter aircraft remain to be seen.** However, the extensive flight test program envisioned for Model 7002 undoubtedly will be a big step toward determining such possibilities.

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* Interview with N. L. Rogers, alternate XF-92 Proj. Eng., 26 Apr. 1949.

** In Jan. 1949 Consolidated submitted to the ANC an informal proposal for a 2-place supersonic fighter utilizing the delta wing and powered by two Westinghouse turbojets with after-burner.

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Interviews with personnel of the Power Plant Laboratory (Engineering Division), and of the Fighter Branches of both the Engineering Division and the Procurement Division were of value in furnishing information not provided by the various records.

The Washington files did not contain any material which was not available at the Air Materiel Command. Interviews with Washington personnel confirmed this fact.

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XF-92

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PHOTOGRAPHS

FIG. 1 — XF-92 FLIGHT

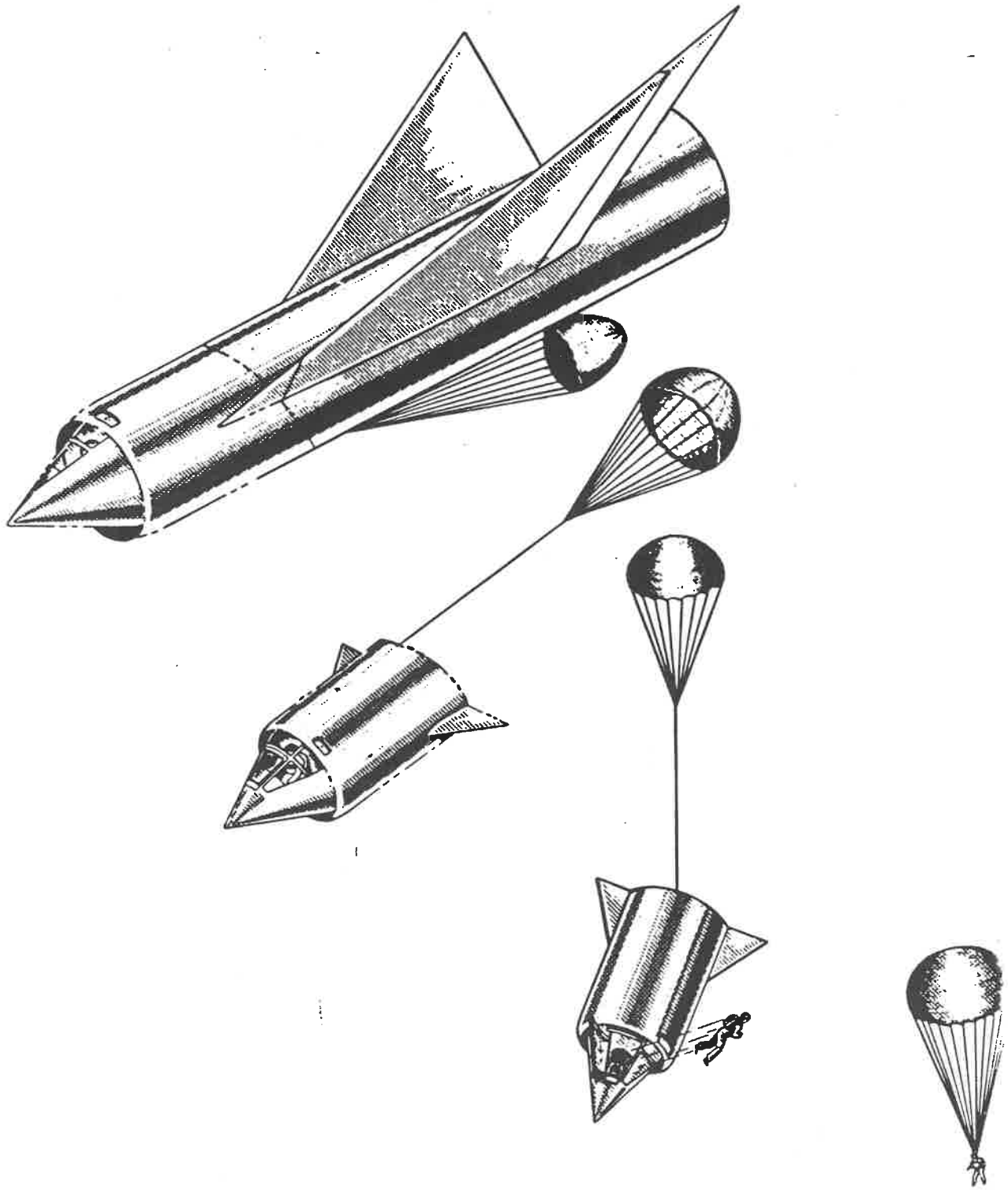

FIG. 5 — XP-92 CAPSULE SECTION - BREAKAWAY SEQUENCE

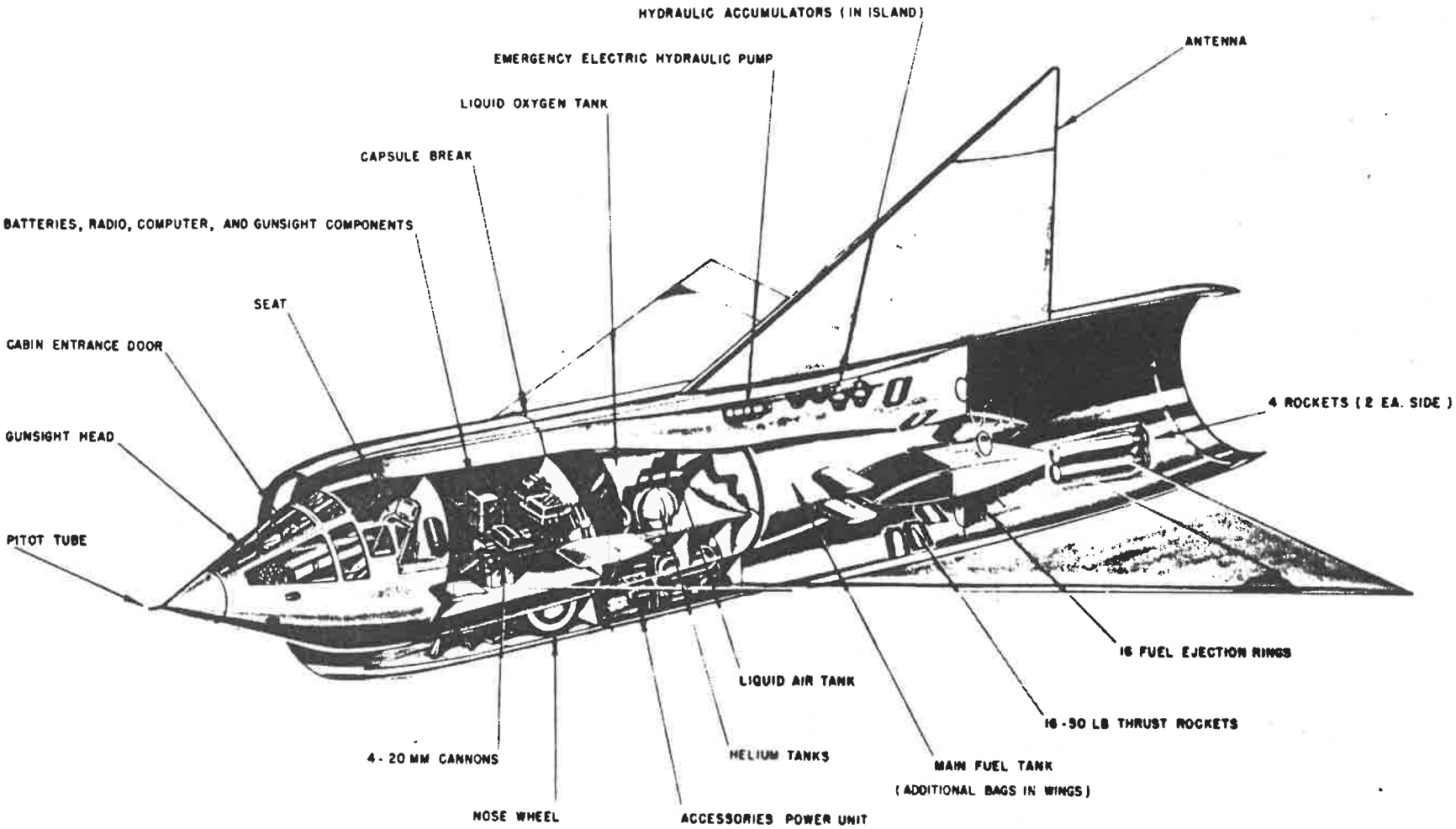

FIG. 1 – XP-92 CUT-AWAY

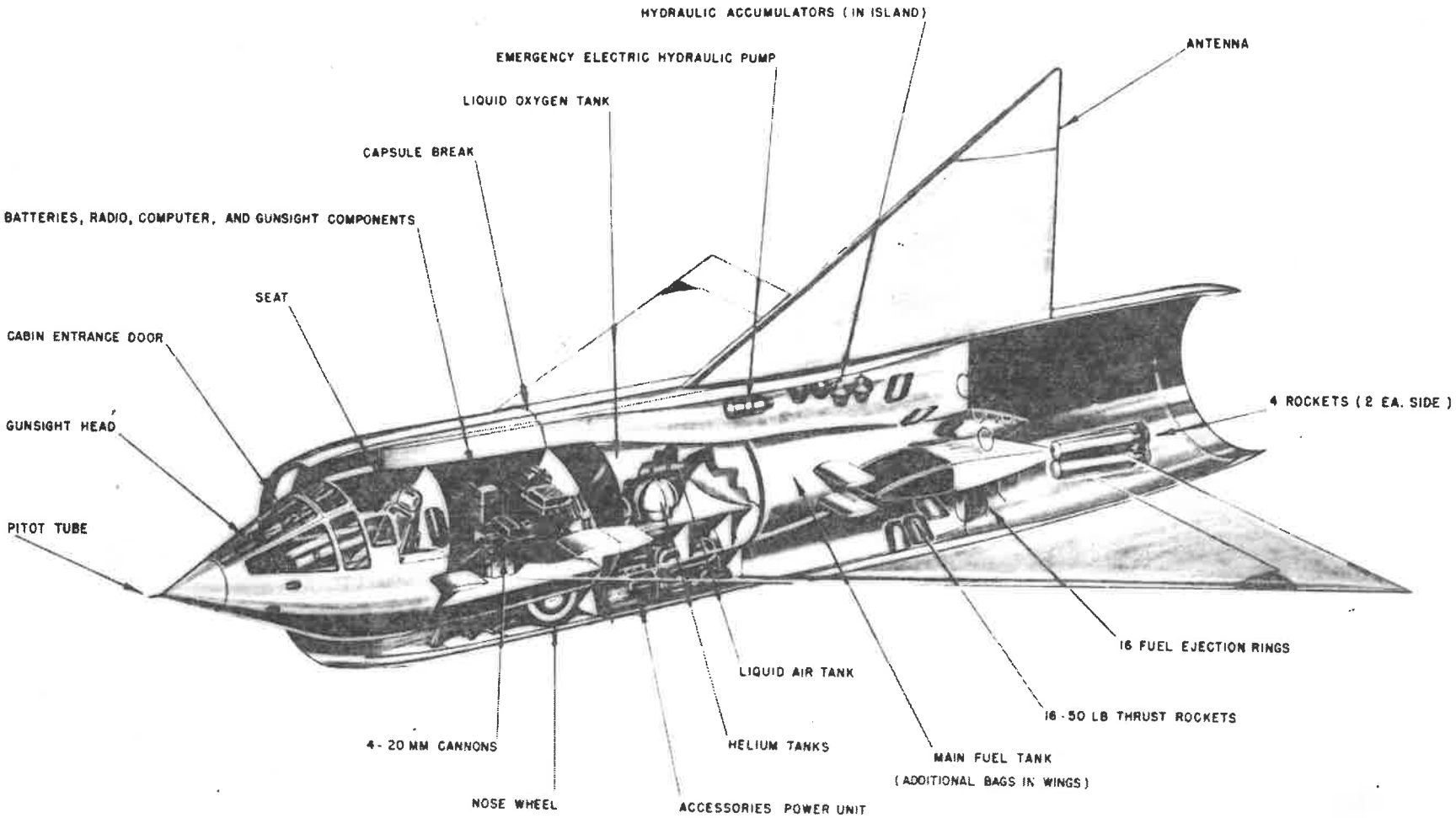

FIG. 1 – XP-92 CUT-AWAY [illegible]

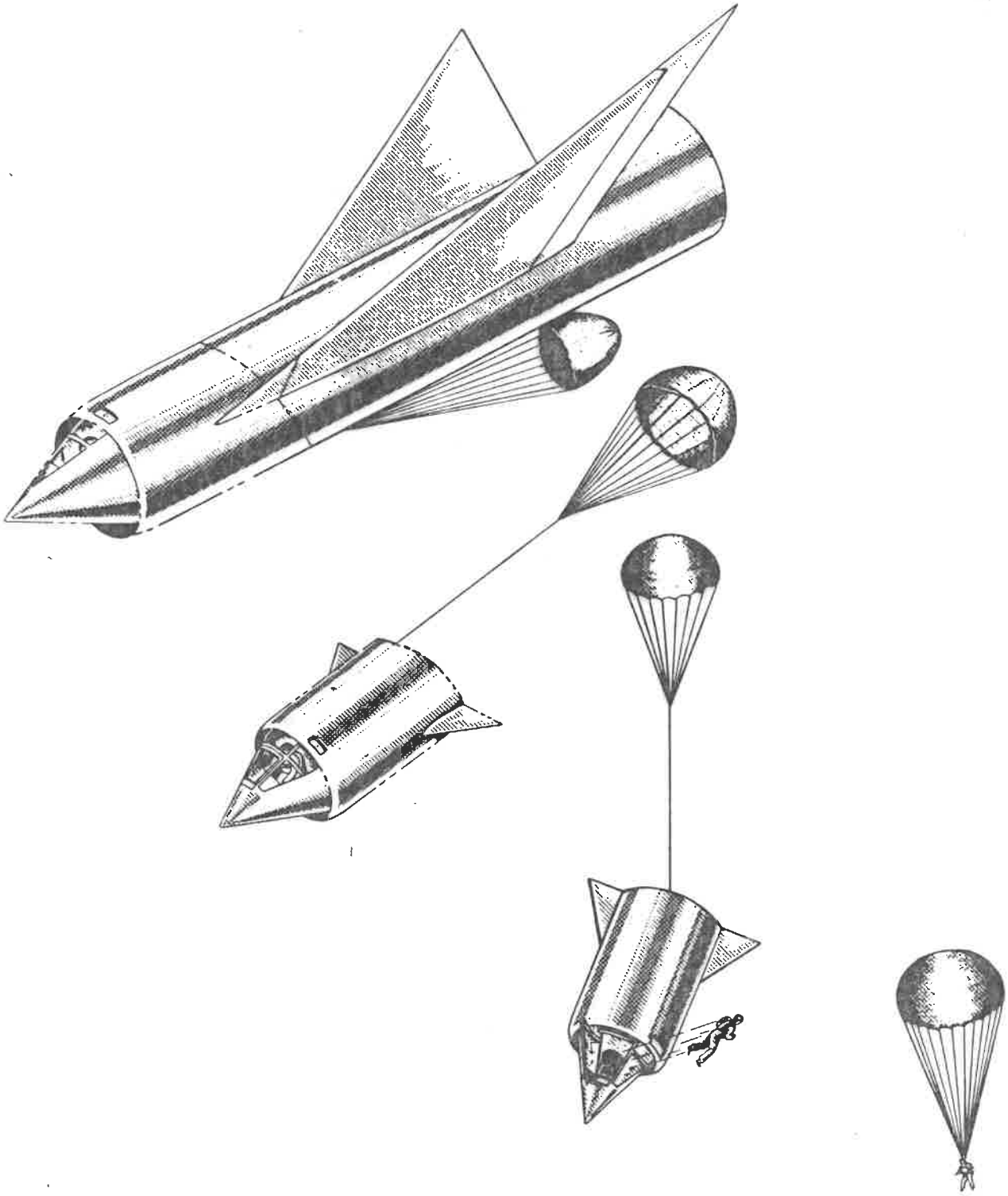

FIG. 5 — XP-92 CAPSULE SECTION - BREAKAWAY SEQUENCE

2.

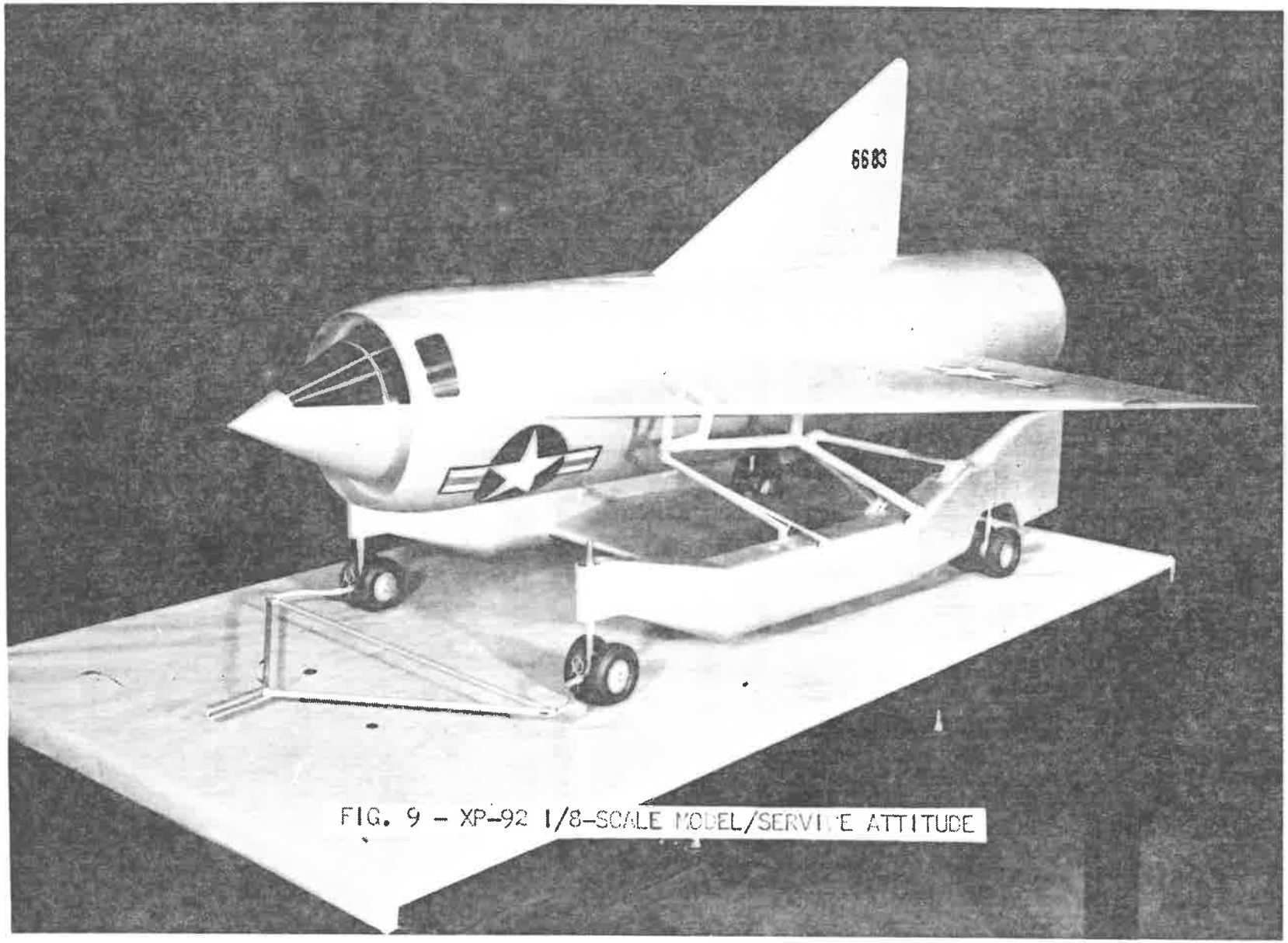

FIG. 9 - XP-92 1/8-SCALE MODEL/SERVICE ATTITUDE

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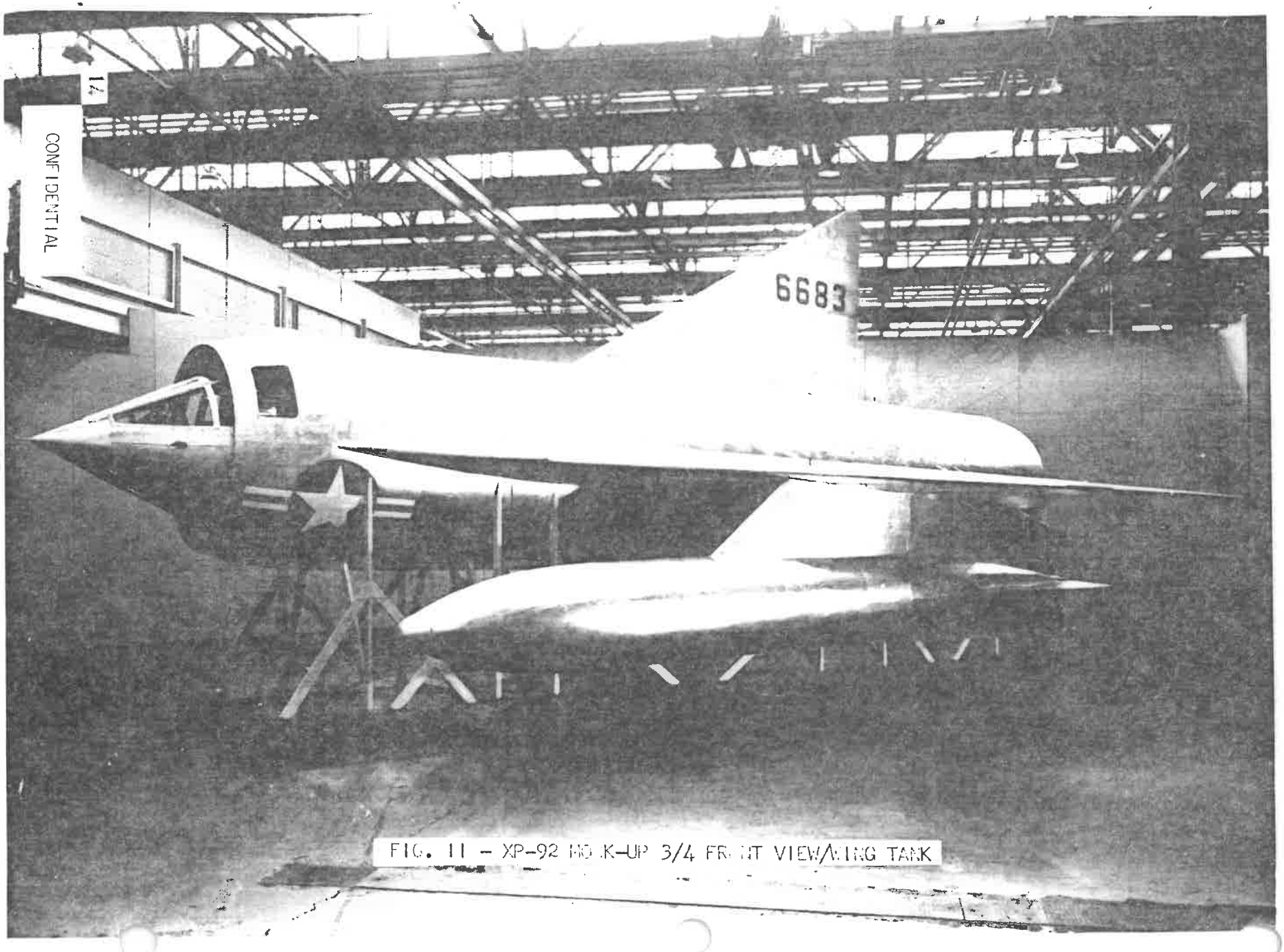

FIG. 11 - XP-92 MOCK-UP 3/4 FRONT VIEW/WING TANK

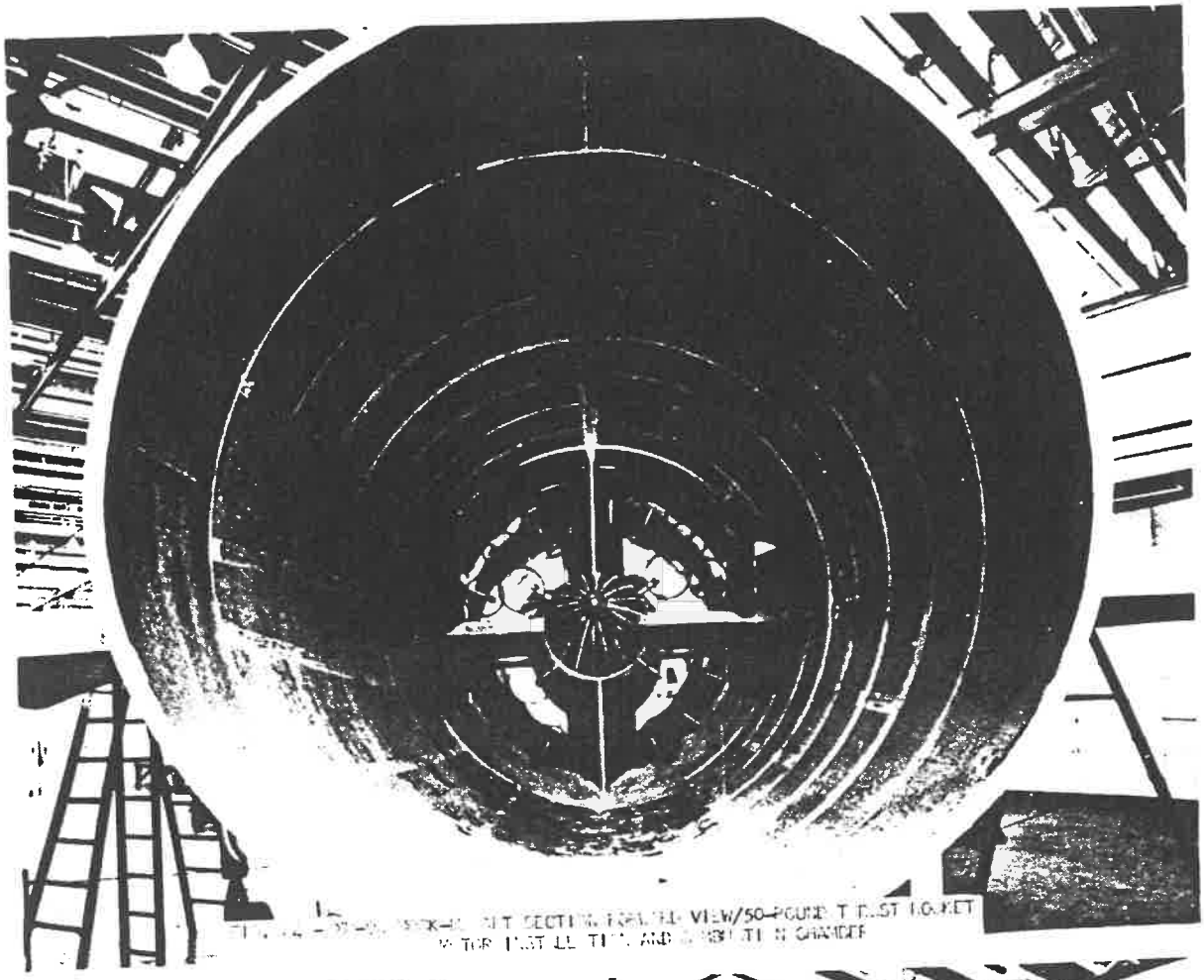

FIG. 24 – XP-92 MOCK-UP INTERMEDIATE SECTION FORWARD VIEW/50-POUND THRUST ROCKET MOTOR INSTALLATION AND [illegible] IN CHAMBER

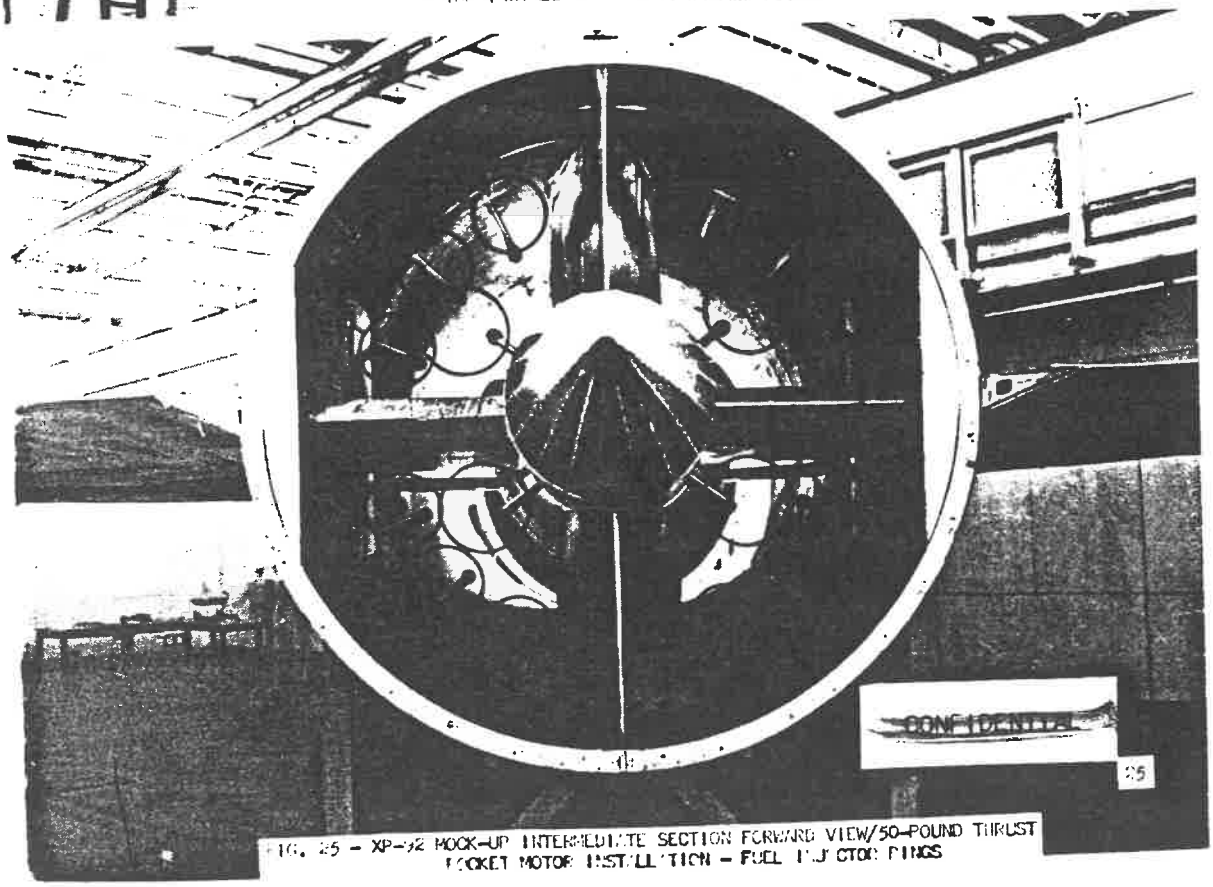

FIG. 25 – XP-92 MOCK-UP INTERMEDIATE SECTION FORWARD VIEW/50-POUND THRUST ROCKET MOTOR INSTALLATION – FUEL INJECTOR RINGS

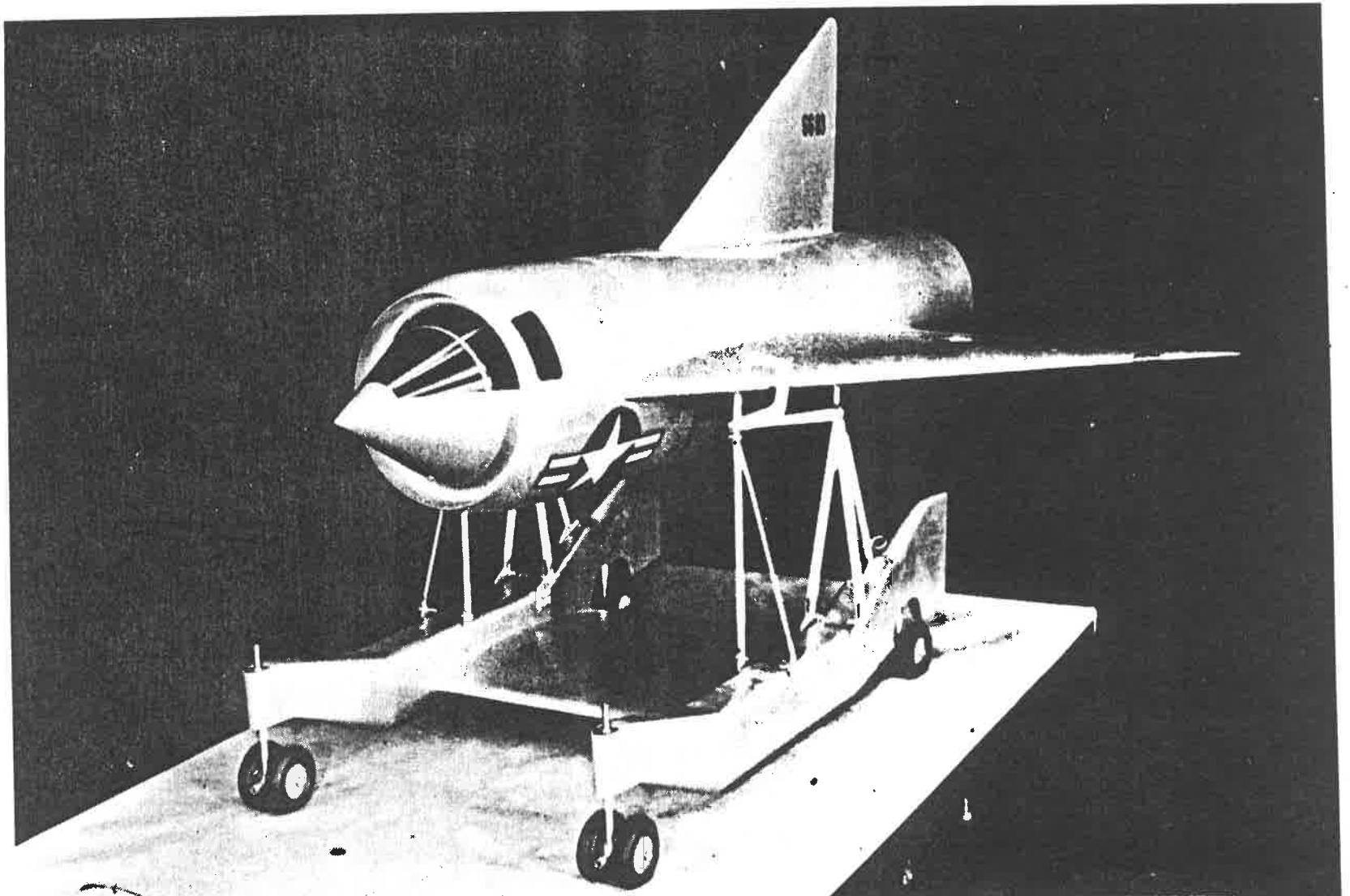

FIG. 7 – XP-92 1/8-SCALE MODEL/TAKE OFF ATTITUDE (WITHOUT WING TANKS)

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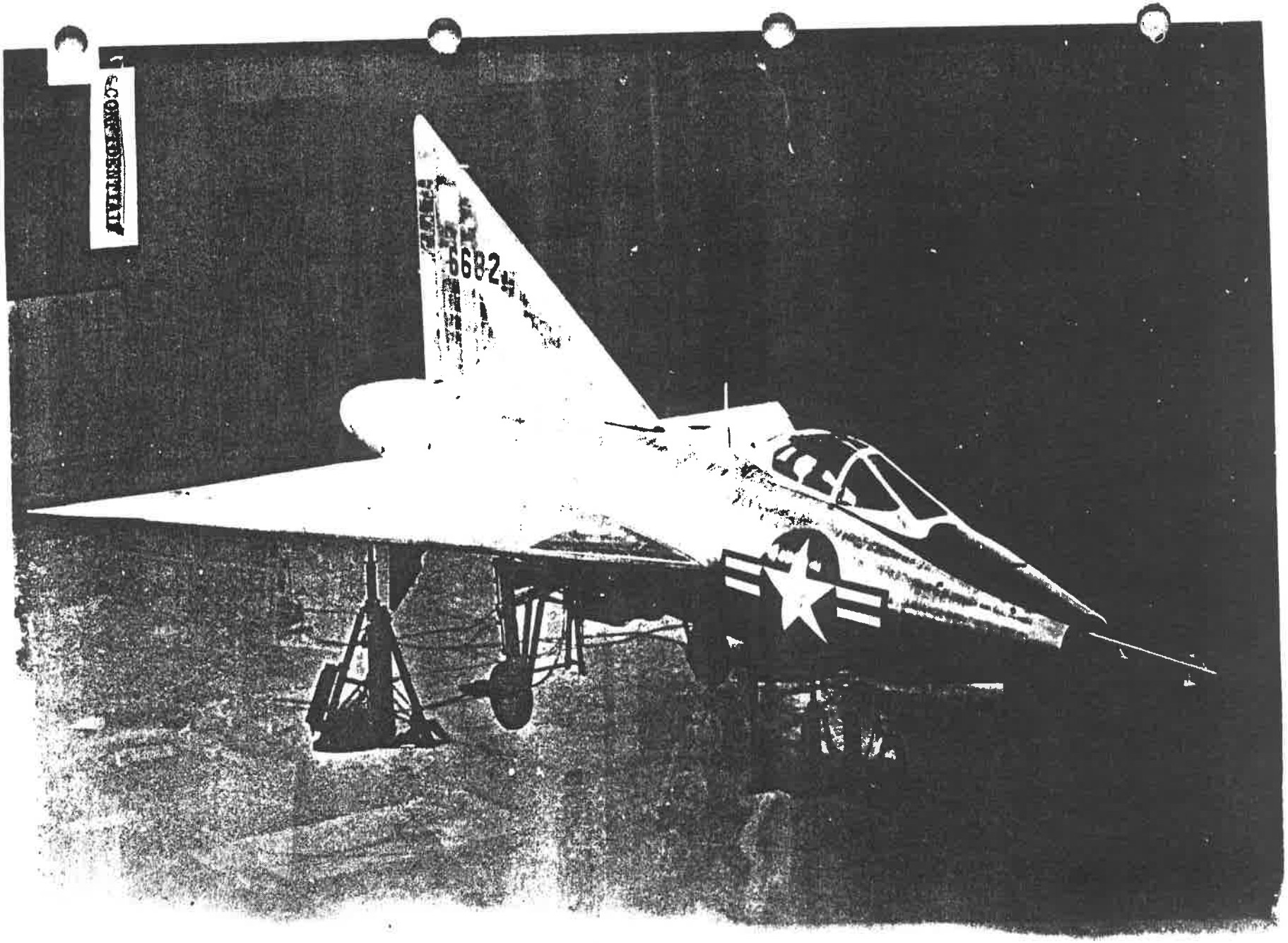

FIG. 34 – XP-92, FULL-SCALE FL